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## **SECTION 16620**

### **SANITARY SEWER PUMP STATION** **EMERGENCY STAND-BY POWER SYSTEM**

#### **PART 1 - GENERAL**

##### **1.01 GENERAL**

Emergency stand-by power systems shall be provided by the Contractor for installation as required in the Contract Documents.

##### **1.02 SCOPE OF WORK**

Provide, install, and acceptance test a complete and operable emergency/standby electric generating system, including all devices and equipment specified herein, required for the services. Equipment shall be new, factory tested, and delivered ready for installation.

##### **1.03 QUALITY ASSURANCE**

- A. Generator sets are acceptable provided they meet all requirements of the specifications and are designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.
- B. The following manufacturers are acceptable provided they meet all requirements of the specifications:
  - 1. Onan/Cummings
  - 2. Caterpillar
  - 3. Or approved equal
- C. Proposed equipment substitutions shall include complete submittal data, as specified herein, clearly denoting any and all deviations and/or exceptions to the equipment specified. The complete proposal must be submitted to the engineer or architect for approval/disapproval not less than 10 days prior to the scheduled bid date.

- D. If approved, the Contractor is responsible for the charges of all necessary revisions.

#### 1.04 RATINGS

As a minimum, the Generator set and Automatic Transfer Switch rating(s) shall be equal to or exceed all electrical loads at the station combined **PLUS 10%** of said total. **IN NO CASE SHALL THE EMERGENCY POWER SYSTEM BE RATED FOR LESS THAN THE MAIN UTILITY SERVICE FOR THE STATION.**

#### 1.05 SUBMITTALS

Submittals should be provided as specified in Contract Documents.

#### 1.06 WARRANTY REQUIREMENT

The Contractor shall provide a no deductible warranty for all products in this section, against defects in materials and workmanship for a period of five (5) years, or 1500 hours of operating time, from the date of final acceptance. Warranty documents shall be executed in the name of the owner as defined in the Contract Documents.

#### 1.07 APPROVED SUPPLIER

The Contractor shall obtain the emergency/standby power system from a supplier whom shall be the manufacturer's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall have 24-hour service availability and factory-trained service technicians authorized to do warranty service on all warrantable and non-warrantable products. Technicians are to be on site with-in 2 hours of call.

## PART 2 - PRODUCTS

### 2.01 DIESEL ENGINE POWER GENERATOR SET

The diesel-engine driven power generator shall be equipped with weather resistant and/or sound attenuated enclosure, skid base fuel storage tank, and Automatic Transfer Switch as described below.

- A. The diesel-engine power generator shall include, but not be limited, to the following features:
  - 1. The prime mover shall be 4-cycle diesel powered with on-board battery charging alternator, spin-on fuel, lube, and (as required) coolant filter(s), dry-element air cleaner, and an integral set-mounted radiator cooling system.
  - 2. The engine shall be certified to U.S. EPA Non-road Source Emissions Standards **40 CFR 89 requirements current at the time of contract award.**
  - 3. The main alternator shall be of brushless, 4-pole, revolving field type with rotor coupled to the prime mover with flexible disc(s).
  - 4. Alternator cooling shall be direct-drive centrifugal blower fan type.
  - 5. Excitation shall be of PMG (permanent magnet) design. **OTHER METHODS OF EXCITATION SHALL NOT BE ACCEPTABLE.**
  - 6. The main alternator shall be broad range, 12-lead and re-connectable for 120/208, 120/240, and 277/480VAC, three phase, four-wire output with an integrated load circuit breaker.
  - 7. The generator set shall meet or exceed Emergency Standby Power ISO 8528 standards.
- B. The generator set-mounted control panel shall have the features listed below as a minimum:
  - 1. Integrated isochronous governing and fuel control in accordance with ISO 3046, AS 2789, DIN 6271, and BS 5514 standards.

2. Integrated 3-phase sensing voltage regulation system with automatic single and three-phase fault regulation.
  3. Integrated AC protective functions to include over/under voltage, short-circuit, over-current, and overload warning and shutdown.
  4. Integrated engine management system to include configurable cycle-cranking functions and configurable start sequencing.
  5. A comprehensive warning and shut-down protection system to include configurable warning and shut-down conditions.
  6. Data display(s) to include 3-phase AC voltage output, load current, engine oil pressure, coolant temperature, DC voltage/current, non-resettable engine elapsed (run) hours, fault status, and fault reset function.
  7. The control panel shall be of NEMA 3R or better construction.
- C. The generator set housing enclosure shall include the following features:
1. 14 gauge low carbon hot rolled ASTM A569 steel construction panels.
  2. 12 gauge low carbon hot rolled ASTM A569 steel construction posts.
  3. Stainless steel assembly and mounting hardware.
  4. Fuel and/or electrical stub-up area within the enclosure perimeter.
  5. Two or three recessed doors per side to provide easy access to service points.
  6. Enclosure shall attach directly to generator skid base or skid base fuel tank.
  7. Enclosure shall be designed for operation in ambient temperatures ranging up to 50° C.
  8. Enclosure shall have easy access lifting points for spreader bars or forklift.
  9. Rain collar and rain cap (or equivalent).
  10. Doors shall be key lockable as well as provided with means to secure with standard padlock(s).

11. Enclosure shall have factory applied corrosion resistant coating (paint).
12. Where required by contract documents the enclosure shall be sound attenuated such that sound pressure at **7 meters** (23 feet) **SHALL NOT EXCEED** the levels listed below:

Units 50kw or smaller	70 db
60KW units	71 db
61KW thru 100KW units	72 db
101KW thru 150KW units	73 db
151KW thru 200KW units	74 db
Larger than 200 KW units	to be determined by area sound survey

- D. The generator set fuel storage tank shall have the features listed below as a minimum:
1. The fuel storage tank shall be skid-base style with sufficient capacity for the generator to run at 100% load for 36 hours.
  2. The tank shall be of **DOUBLE-WALLED** design compliant with UL 142, and NFPA 37.
  3. The tank shall be equipped with UL listed venting devices, rupture basin leak detection device, tank level indicator (fuel gauge) device, and a pad-lockable fuel filler cap.
  4. The tank shall have appropriate penetrations and pick-up tubes for supply and return fuel lines to the engine (sized as recommended by engine manufacturer). Flexible fuel lines, applicable fittings, and necessary "loss-of-prime" prevention device(s) shall also be supplied.
  5. The tank shall be constructed such that a minimum of one (1) inch of clearance exists between the tank bottom and the mounting surface to which it is anchored for air circulation.
  6. The tank shall be constructed such that its **overall height shall not exceed 36 inches**.
  7. The tank shall have an appropriate means for anchoring to a concrete slab.
  8. The electrical conduit stub-up area shall mate with the generator housing stub-up area and shall be **EASILY ACCESSIBLE** by means of removing an access plate from the assembly.

9. The generator set and housing shall be securely mounted on top of the fuel tank with **Grade 8 stainless steel fasteners** (to be supplied with the tank).
  10. All external surfaces of the fuel tank shall be coated with brush/roller- applied truck-bed type liner coating (Herculiner or equivalent) to provide extra weather protection. **This coating shall be “touched-up” as necessary following final assembly of the system.**
- E. The Automatic Transfer Switch (ATS) shall have the below-listed features as a minimum:
1. The ATS shall be of 3-Pole, Double-Throw design with a fixed neutral buss.
  2. The ATS shall be rated for continuous operation of the main power service to the station plus 10% at a minimum.
  3. The ATS shall be equipped with a **TYPE 4** enclosure.
  4. The ATS shall be in complete compliance with UL 1008 and have UL listed CU-AL terminals.
  5. The ATS shall be compliant with NFPA 70, 99, and 110.
  6. The ATS shall be compliant with NEMA ICS 10 and IEEE 446.
  7. The ATS shall be equipped with arc shuts to cool and quench arcing, with barriers to prevent inter-phase flashover.
  8. The ATS shall be equipped with a full-current rated neutral bar with terminal lugs.
  9. The ATS shall be rated to carry 100% of its rated current at rated voltage continuously within the enclosure. **CIRCUIT BREAKER AND/OR MOLDED CASE SWITCH TYPE ATS's SHALL NOT BE ACCEPTABLE.**
  10. The ATS shall be equipped with a minimum of two sets of dry C-Form contacts (one set for each power source) for remote indication of which power source (Normal or Emergency) the load is connected to. These contacts shall be readily accessible through the use of terminal strips for easy field wiring. Contacts shall be rated 250VAC @ 10AMPS.

11. The ATS shall be equipped with a manual operating capability suitable for user operation.
12. The ATS operating mechanism shall be open transition (break-before-make) design with mechanical **AND** electrical interlocking feature(s) which preclude closing the load to more than one power source at a time.
13. The ATS transfer mechanism shall be designed as an “H-Frame” device which has three distinct positions (i.e. off, on-normal, and on-emergency). The mechanism shall be constructed such that it can be placed in any of its three positions in a de-energized state and the mechanism will stay in that position until physically placed in another.
14. The ATS power contacts shall be manufactured of high pressure silver alloy material to resist burning and pitting; thus contributing to long service life.
15. The ATS shall be equipped with user-adjustable time delay features as shown below:

Time Delay Engine Start	(TDES)
Time Delay Normal-to-Emergency	(TDNE)
Time Delay – Load w/o Power	(TDPT)
Time Delay Emergency-to-Normal	(TDEN)
Time Delay Engine Cool-down	(TDEC)

16. The ATS shall be equipped with exerciser function contacts. These shall be wired to SCADA System exercise function Contacts. The SCADA system will supply a Relay Contact (dry contact, Normally Open) to initiate the exercise function. On SCADA energizing relay (contact closure) generator will exercise until relay is de-energized. Normal time delays from Section 2.01 E 15 (above) still apply.
17. The ATS integrated control shall have these feature/functions:
  - a) Voltage sensing of all normal side phases with user adjustable pick-up and drop-out points.
  - b) Voltage sensing of at least one phase of emergency power with user adjustable pick-up and drop-out points.
  - c) Control push-button(s)/switch(es) to initiate a test and/or override selected time delays.

- d) User-programmable exercise and test functions for exercising and/or testing under “with load” and “without load” conditions.
- e) Front panel display(s) showing power source availability and source connected to status.

F. System Accessory Item(s):

1. The engine-generator shall be equipped with a “tank” style coolant heater (size as recommended by the engine manufacturer) to assist with rapid engine starting.
2. The engine-generator shall be equipped with a “float” type battery maintainer-charger mounted inside the generator enclosure. It shall be readily accessible by the equipment operator and shall meet the requirements of **NFPA 110 (2010 Edition) paragraph 5.6.4.7** in order to maintain the engine starting battery(s) in a ready condition.
3. A 120VAC receptacle shall be installed for coolant heater and battery charger use.
4. The engine-generator shall be equipped with the manufacturer’s recommended lead acid starting battery(s) and associated cables.
5. The engine-generator shall be equipped with manufacture’s recommended exhaust system.

## **PART 3 – TESTING**

### **3.01 GENERAL**

Generator set factory tests on the equipment to be shipped shall be performed at rated load and at 0.8 PF. Generator sets that have not been factory tested at 0.8 PF shall not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pick up, and safety shut downs. Provide a factory certified record of the production testing.

### **3.02 ON-SITE ACCEPTANCE TEST REQUIREMENTS**

The Emergency Power System acceptance and start-up shall include the following listed checks, tests, and services:

- A. Installation of starting battery(s) and adjustment of the battery charger.
- B. Install flexible fuel lines and verify correct installation of any feeder fuel piping and fittings. Prime the fuel system.
- C. Verify that all electrical load and control wiring is properly installed and that all terminations are properly tightened.
- D. Verify the correct assembly of all the various system sub-assemblies (housing, fuel tank, etc.).
- E. Start and run the generator unit under “no load” conditions to verify correct governing and voltage output.
- F. Verify that phase rotation and “hi leg” on the emergency side of the transfer switch matches the normal (utility) side as applicable.
- G. Verify correct operation of the automatic transfer switch in response to both “power-fail” and “system test” conditions with no load applied.
- H. Verify correct system operation under simulated power failure conditions with actual station load applied.

1. The system shall automatically respond to a power failure condition by starting the generator and correctly transferring the load to the emergency power source (verify that applicable time delay functions are correct).
2. The system shall automatically respond to normal power restoration by re-transferring the load to the normal power source and returning to a standby condition (verify that all applicable time delay functions are correct).
3. Put station on emergency power. Start **ALL** loads **SIMULTANEOUSLY** and verify that there is **NO CONTACTOR "CHATTER"**, that there is **NO RELAY DROP-OUT** in the control (no matter how short the duration) due to voltage drop as a result of in-rush load effects when the load is applied. "Stagger-Starting" of pumps **SHALL NOT BE ACCEPTABLE** unless specifically called for in the contract documents and technical drawings.
4. **All system loads shall start and run smoothly WITH NO DEGRADATION of function of ANY sub-system at the station while operating on emergency power.**
5. Verify correct operation of **ALL** engine safety shut-down/ warning functions.
6. Adjust all time delay functions to user requirements and set the exerciser function and time period to end-user requirements.
7. The system shall be load tested at 100% of rated load for two consecutive hours in compliance with NFPA 110 using a resistive load bank.
8. Demonstrate a 100% rated load single-step pick-up.
9. A copy of the acceptance testing record (to include load banking results) shall be furnished to the end-user department head in addition to any other required copies specified in the contract documents.

**END OF SECTION 16620**